Misys Healthcare Systems (formerly Sunquest Information Systems)

Automated Data and Alert System for Hospital Physicians

In the mid-1990s, insurers and consumers were concerned about spiraling healthcare costs due in part to delays in relaying correct information to caregivers and inefficiencies and inaccuracies in dispensing antibiotics to patients. Sunquest Information Systems proposed to enhance patient care and reduce costs by developing a more complete, automated, and real-time patient information and decision-support system for the hospital environment. The company applied for Advanced Technology Program (ATP) funding under the "Information Infrastructure for Healthcare" focused program to develop a system that would improve diagnostic accuracy and speed, enhance the use of laboratory tests, and reduce the overall cost of healthcare. The company proposed an infectious-disease surveillance system to proactively deliver patient information to clinicians. High technical risks, which precluded commercial funding sources, included designing a system that would be compatible with existing hospital systems and that was highly accurate, because errors could cost patient lives. Sunquest began its project in late 1995.

After a year into the project, enhancements in technology available in the marketplace afforded Sunquest the opportunity (with ATP approval) to simultaneously develop two electronic medical systems: the Clinical Event Manager (CEM) and the Antibiotic Consultant (QID). The CEM proved to be an effective management and cost-savings system, while the QID continues to hold promise as a working tool. Development of these tools led to the publication of two articles. After the project ended in 1998, Sunquest tested the CEM in hospital settings for 3 years at as many as 13 client sites. ATP support accelerated CEM and QID development by several years.

Attracted to the quality, effectiveness, and potential of these Sunquest systems, Misys Healthcare Systems acquired Sunquest in 2001. Misys renamed Sunquest's CEM system "Insight," incorporating 85 percent of the original, ATP-funded system. As of 2006, Insight serves as an all-encompassing patient data and alert system that sends immediate medical notifications and is being used at 16 to 20 Misys hospital client sites. Technological innovations from this project have led to improved care for patients and a reduction in healthcare costs, as demonstrated during Insight's use at test sites.

COMPOSITE PERFORMANCE SCORE
(based on a four star rating)
* *

Research and data for Status Report 95-10-0008 were collected during December 2005 – January 2006.

Inaccurate Patient Information Is a Growing Concern

While electronic patient information databases have been in use since the 1970s, by 1995, the hospital environment still did not have a comprehensive system to accurately gather and instantly relay patient information to physicians and other caregivers. In fact, patient information collection systems provided limited capabilities, were often manual, and contained many inaccuracies.

Another significant problem in the hospital setting was the excessive and inappropriate use of antibiotics,

which often resulted from faulty and hasty decision-making. Many physicians chose broad-spectrum antibiotics because these were considered the easiest and safest choice, although they were usually the most expensive choice. Furthermore, this non-specific dispensing of antibiotics accelerated the emergence of antibiotic-resistance pathogens, which increased healthcare costs to society. In the mid-1990s, it was estimated that some 50 percent of antibiotic use was inappropriate, either because no antibiotic was required or the wrong one was prescribed. The Centers for Disease Control and Prevention estimated in 1998 that about 100 million courses of antibiotics were prescribed by office-based physicians each year, and approximately one-half of those prescriptions were unnecessary.[1]

Sunquest Proposes to Deliver an Information-System Solution

Sunquest Information Systems, a medium-sized company dedicated to the development of hospital information systems, saw the need for a system that addressed the inaccuracy and misuse of antibiotics. In 1995, Sunquest applied to ATP under the "Information Infrastructure for Healthcare" focused program for funds to develop an all-encompassing, real-time decision support tool for antibiotic delivery called the Antibiotic Consultant (QID). The high technical risk involved in designing and implementing the system precluded commercial funding sources.

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Sunquest's objective was to build an "open" or interoperable clinical decision-support system that could plug into any existing HL7-compatible information technology environment. (An HL7, or Health Level 7, system standardizes vocabulary and grammar so that medical data can be shared and understood by all healthcare clinicians. Use of the HL7 allows all systems to communicate with one another without the need for information conversion.) The proposed system would also use existing industry tools to provide "push" technology (data sent as opposed to requested) so that important clinical information would be automatically forwarded to the provider. Sunquest would rely on partnerships with the University of Utah Medical Center to provide assistance with vocabulary and knowledge base construction, Columbia Presbyterian Medical Center to contribute their MedLEE technology for natural language processing, and Moses Cone Health Systems to provide infectious disease consultation and a test lab once technology was developed.

Sunquest's primary technological challenge was to develop an appropriate tool or system to increase the accuracy and timeliness of delivering patient information. The system would have three major components:

- Appropriate natural language processing, which is the process of narrowing the ambiguities and complexities of human languages into a more definable scheme for a computer system
- Accurate vocabulary mapping; in this case, the process of relating the terms of two or more medical vocabularies into a single, understood meaning
- Sophisticated expert system that could process and relay patient information, including patient care recommendations for the clinician

There were two especially high-risk technical challenges for this project. One was the requirement to effectively combine the three elements listed above into one working system and to make the system exceptionally accurate, because patient health and lives were at stake. The second challenge lay in constructing a systems tool that would be compatible with or extensible to existing hospital systems. Because most hospital systems were "closed," or not interoperable with a new system, the QID would have to achieve a high level of openness and connectivity with essentially enclosed hospital systems.

[1] Dowell, Scott F. "*Principles of Judicious Use of Antimicrobial Agents for Pediatric Upper Respiratory Tract Infections*." PEDIATRICS (Supplement, January 1998): pp. 163-165.

Clinical Event Manager Would Reduce Cost and Improve Accuracy of Care

If successful, the benefits derived from the QID would include the early identification of patients with life-threatening complications, improvements in diagnostic accuracy, efficacy in ordering appropriate medical tests, and dissemination of proactive treatment guidelines. Patients, clinicians, and taxpayers would all benefit. Patients would receive optimal and effective care, clinicians would increase productivity without additional effort, and taxpayers would see dramatic reductions in healthcare costs resulting from more prompt and effective treatments.

The ATP-funded project began in the fall of 1995 with three primary technical objectives:

- Develop a reusable, extensible, and maintainable electronic system for accomplishing infectious disease monitoring (reusable refers to a system that can be constantly updated)
- Develop an "open" interface from clinical computing environments to the expert system using industry standards such as HL7
- Design solutions that would allow the immediate development of vocabulary and knowledge bases for medical domains within and beyond infectious disease

Development of the vocabulary and knowledge bases and the electronic interface with processes used in the existing hospital computing environments moved forward. However, increasing the sophistication of the QID by adding the probability of patient disease factors to the knowledge and vocabulary bases was slowing development of the tool. Therefore, Sunquest took the technical applications that had been developed at that juncture and began focusing on a second system, a more general medical records hospital system called the Clinical Event Manager (CEM).

By the final quarter of 1996, the ATP-funded project was proceeding along two distinct paths: CEM and QID. The CEM used rules-based logic to monitor data intended for an electronic medical record, where messages were automatically written to alert care providers to important patient information. These messages were transmitted electronically to existing e-mail accounts and/or to wide-screen pagers. The CEM would attempt to incorporate the emerging object-oriented technology into the clinical decision-support field. (Object-oriented technology comprises a group of individual units, or objects, that interact with each other and have the capacity to receive and process data and messages with other objects.)

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The CEM would also attempt to use component-based architecture, a design in which a group of components has the ability to interface with a common or existing mechanism or system. Using component-based architecture would allow the CEM to connect with any web server by using HTTP and HTML in order to facilitate the delivery of patient information to healthcare providers. The CEM is real-time, proactive "push" technology that "listens in" on the hospital's clinical data being transferred between clinicians, nurses, pharmacists, and scheduling staff. The CEM filters the clinical data; looks for selected critical events in laboratory, pharmacy, demographic, and radiological information; and then sends alerts and reminders regarding vital patient data to caregivers by way of pagers and/or e-mail.

Using their alpha test site at the University of Utah Medical Center, the company went live with the CEM in 1996. Eleven clinicians began receiving patient information alerts/reminders from the CEM via e-mail and pagers. These alerts were customized to the needs of each recipient based on criteria established by the individual clinicians. Later in the year, the number of clinicians using the CEM at this alpha site increased to 28.

Sunquest had developed the QID to the working prototype stage, and it was ready for evaluation at the University of Utah. The QID's progress was tied to the development of highly accurate, well-defined antibiotic and disease vocabulary and knowledge bases. Sunquest had made gains in this area, so the company

made a strategic decision to develop the QID for integration into the CEM as a specialized alert/notification tool.

By the end of 1997, the CEM was proving reliable and effective. It provided alerts that addressed many clinical and administrative problems that occur in a hospital setting. The CEM went live at Moses Cone Hospital in Greensboro, NC during this time, and several other hospitals expressed interest in becoming clients.

Physicians Report Benefits Using the CEM

With 50 users at two different sites, clinicians at the University of Utah Medical Center and Moses Cone Hospital began formally evaluating the CEM. The most common feedback from physicians fit into the following three categories:

- By using the CEM page alert service, they received clinical information faster than previously.
- They received more complete information, including information they might not have known about such as drug and laboratory alerts.
- They saved time by using the CEM and made fewer trips to the patient chart or computer to extract information.

Because the physicians had access to more complete and timely data, they were able to discharge patients earlier and prevent complications from drug interactions. Specific examples of areas where cost savings could be realized on a yearly, per-hospital, total patient basis included the following:

- Patients who showed a low probability of a heart attack could be discharged at least one day earlier from the intensive care unit, saving between $91,520 and $598,000.
- Patients with Deep Vein Thrombosis could be switched sooner to low-molecular-weight heparin (Lovenox) from general mechanical and drug therapies and could be sent home earlier, saving between $38,480 and $257,520.
- Patients receiving expensive and labor-intensive intravenous medication could be switched sooner to oral forms of medication, saving between $31,615 and $53,390.
- Physicians could quickly detect drug interactions and prevent complications, thus avoiding increased hospital lengths of stay, cost of care, and potential legal costs, which could save $148,863.

CEM Readied for Hospital Use

Sunquest negotiated several promising contracts with hospitals to use the CEM in 1998. Developers increased the number of rules with the CEM knowledge base from 295 to more than 400. The rules describe a situation and the recommended action by a clinician under that particular circumstance. The situations for these rules included admission diagnosis, visit information, patient demographics, lab orders, lab results, culture results, susceptibility results, and drug orders.

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The QID tool also showed progress in 1998. Sunquest refined and updated the QID knowledge tables to increase their accuracy. A subsequent evaluation of the QID demonstrated progress, but revealed that the product was not yet ready for introduction into the commercial arena. It was unable to attain the high level of accuracy needed for a physician support system.

Misys Acquires Sunquest and Continues Development

The ATP-funded project ended in 1998 and during the next three years, Sunquest's CEM began to make inroads in the marketplace. For example, by 1998, the CEM was operating in 6 hospitals and by 2001, it was being used in 13 hospitals. During this time two published journal articles touted the emergence and quality of Sunquest's CEM tool, and this new technology earned the company finalist status in Microsoft's 1998 Independent Software Vendor Product of the Year

competition. The CEM's technical effectiveness drew the attention of one of the leading providers of hospital information systems in the country, Misys Healthcare Systems, which acquired Sunquest in 2001 for $404 million. Over the next two years, Misys invested more than $1 million in CEM and QID development. Misys derived sufficient revenue from CEM sales to offset its investment in these tools. According to Chris Callahan of Misys Healthcare Systems, essentially Misys "took CEM, renamed it, and turned it into Insight." As of 2006, 85 percent of Insight was Sunquest's CEM.

However, while the CEM/Insight technology is "first rate," the commercial success of this product has proven to be "less than moderate" and "limited," according to Callahan. While Misys currently serves some 1,300 sites and has 650 hospital clients, the Insight system serves only 16 to 20 clients (up from 13 Sunquest clients in 2001). Furthermore, Insight generates less than 10 percent of Misys' revenues. The challenge in advancing this system commercially, according to Callahan, is that while Insight can easily monitor and receive basic information sent by a hospital's HL7 system, physicians must still "log on to and maintain rules as if it were a separate system." This aspect has proven to be burdensome and an obstacle for hospitals.

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Two challenges forestalled the success of QID: Misys lacked the technical expertise at the time of the Sunquest acquisition to advance the project, and the market was not yet ready for the QID as a standalone product. Sunquest's inability to reach its goal of making the QID a "plug-and-play" tool hurt its marketability. The development plan for the QID tool is to incorporate it as part of an overall support system. According to Callahan, Misys expects to partner with TheraDoc, a company that develops clinical decision support software, in an effort to make the QID a part of Misys' Computerized Patient Record (CPR) system. This collaboration of Misys and TheraDoc software expertise is expected to begin by 2008 with a new product introduction the following year.

Conclusion

Sunquest Information Systems developed an effective management and cost-savings system, Clinical Event Manager (CEM) (later renamed Insight after Sunquest was acquired by Misys). The CEM has contributed to improved hospital service, efficacy, and medical system interoperability. The CEM provides physicians with accurate, real-time alerts regarding patient condition, tests, or medication. The system, which has experienced both technical and commercial success, is being used in 16 to 20 hospitals, and usage is expected to increase. Sunquest also developed the Antibiotic Consultant (QID) during this ATP-funded project, a tool with significant potential. Misys expects to form a partnership with another medical software company to further develop the QID. Should this collaboration prove successful, the QID is expected to provide clinicians with antibiotic surveillance and real-time support as soon as 2009. Researchers discussed the development of both the CEM and QID in two journal articles. The CEM and QID figure prominently in the overall use and effectiveness of hospital information systems, producing benefits for patients, physicians, hospitals, insurance companies, and American taxpayers.

PROJECT HIGHLIGHTS
Misys Healthcare Systems (formerly Sunquest Information Systems)

Project Title: Automated Data and Alert System for Hospital Physicians (Automating Disease Surveillance from Structured and Text Data)

Project: To develop a more complete, computerized, real-time patient information and decision-support system for use by physicians within the hospital environment.

Duration: 10/15/1995 - 6/30/1998
ATP Number: 95-10-0008

Funding (in thousands):

ATP Final Cost	$1,969	70.2%
Participant Final Cost	837	29.8%
Total	$2,807	

Accomplishments: With ATP funding, Sunquest Information Systems (acquired by Misys Healthcare Systems in 2001) achieved technical and commercial successes in their development and advancement of more complete, automated patient information and real-time, decision-support systems for the hospital environment. They developed two systems tools, the Clinical Event Manager (CEM) and the Antibiotic Consultant (QID), and accomplished the following:

- Developed more sophisticated vocabulary and knowledge bases for medical domains other than those focused on infectious disease
- Developed an "open" interface, the CEM, that facilitates communication from clinical computing environments to the expert system, using Health Level 7 standards. (An HL7, or Health Level 7, system standardizes vocabulary and grammar so that medical data can be shared and understood by all healthcare clinicians. Use of the HL7 allows all systems to communicate with one another without the need for information conversion.)
- Added a "push" (data sent as opposed to requested), real-time medical information alert tool, CEM, for physicians
- Advanced the development of a reusable, extensible, and maintainable electronic system, the QID, to monitor infectious disease to the point where the system is capable of being incorporated in an existing hospital system to provide surveillance and consulting on the use of antibiotics for individual patients
- Acknowledged as a 1998 Finalist for Microsoft's Independent Software Vendor Product of the Year

Commercialization Status: In early 1997, Sunquest went live with the CEM at its alpha site, the University of Utah Medical Center. By the end of the ATP funding in mid-1998, the CEM was in commercial use at 13 hospital sites. By the end of 2005, the CEM (after being renamed Insight by Misys) was operating in 16 to 20 hospital settings. The QID is still under development, and Misys expects to incorporate it as a supplement to one of their existing records management systems as soon as 2009.

Outlook: The outlook for Misys' automated data and alert systems is good but clouded. Insight is being used in 16 to 20 hospital settings, with sales growth expected. While both technical and commercial success has been achieved, additional technical advances for the CEM and QID are necessary for these products to garner a significant share of the automated medical systems market. In 2008, Misys anticipates partnering with another company to incorporate the QID into Misys' Computerized Patient Record System.

Composite Performance Score: * *

Focused Program: Information Infrastructure for Healthcare, 1995

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Subcontractors:

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- Moses Cone Health System
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Publications:

- Warner, Homer R., et al. "Clinical Event Management using Push Technology – Implementation and Evaluation at Two Health Care Centers." *Proceedings of the AMIA Annual Symposium*, pp. 106-110, 1998.
- Guo, Di, et al. "Design and Architecture of Asynchronous Push Technology as a Clinical Decision Support Methodology." *Journal of Healthcare Information Management*, Vol.13, No. 2, pp. 111-118, 1999.